2011 Georgiana Slough Non-Physical Barrier Study

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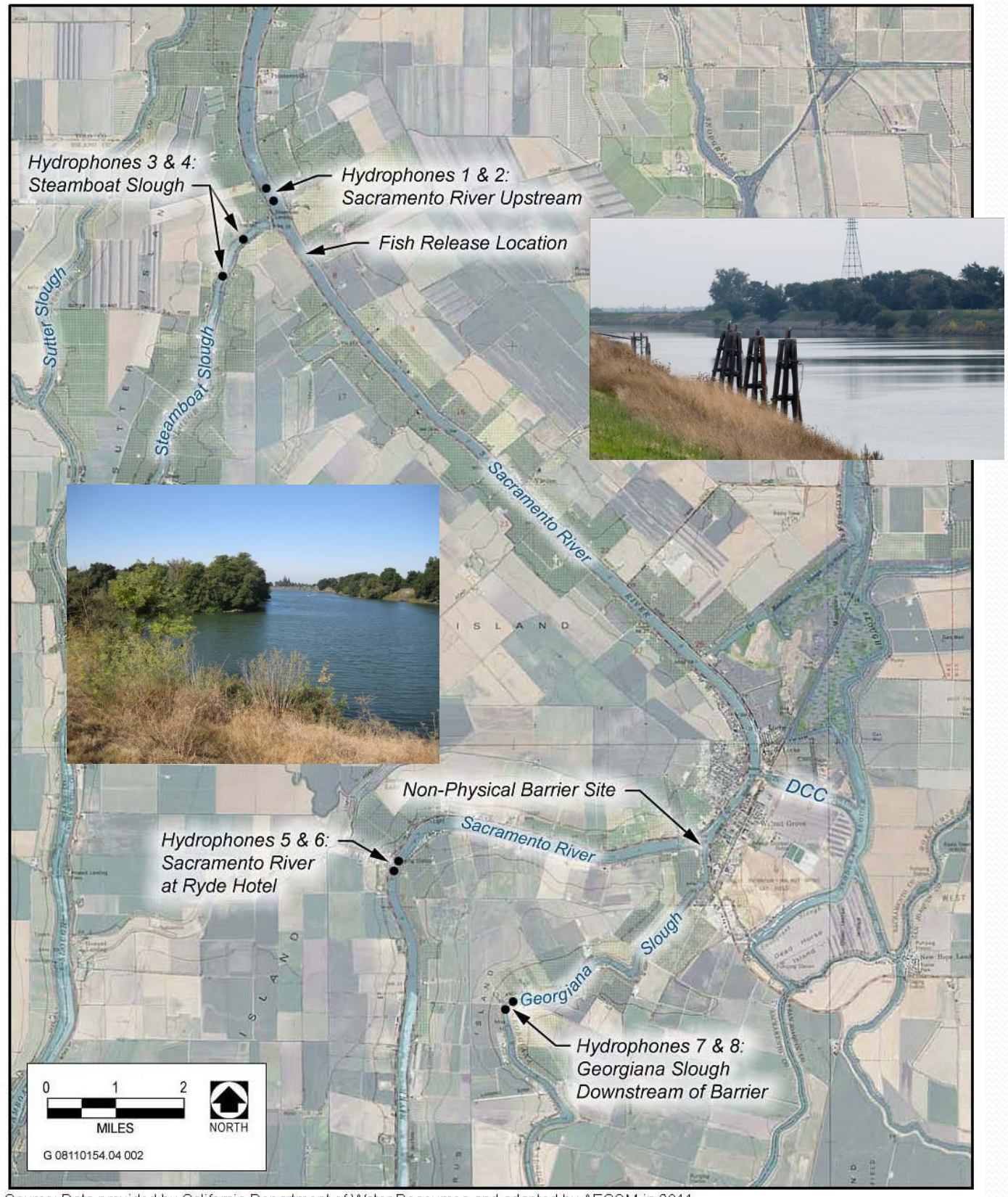
Presentation Outline

- Study Plan
- Barrier Design
- Barrier Operation
- Preliminary Results
- 2011 Study Conclusions
- Possible Future Considerations for Non-Physical Barrier Evaluations
- Individual Based Modeling Overview

Study Plan Overview

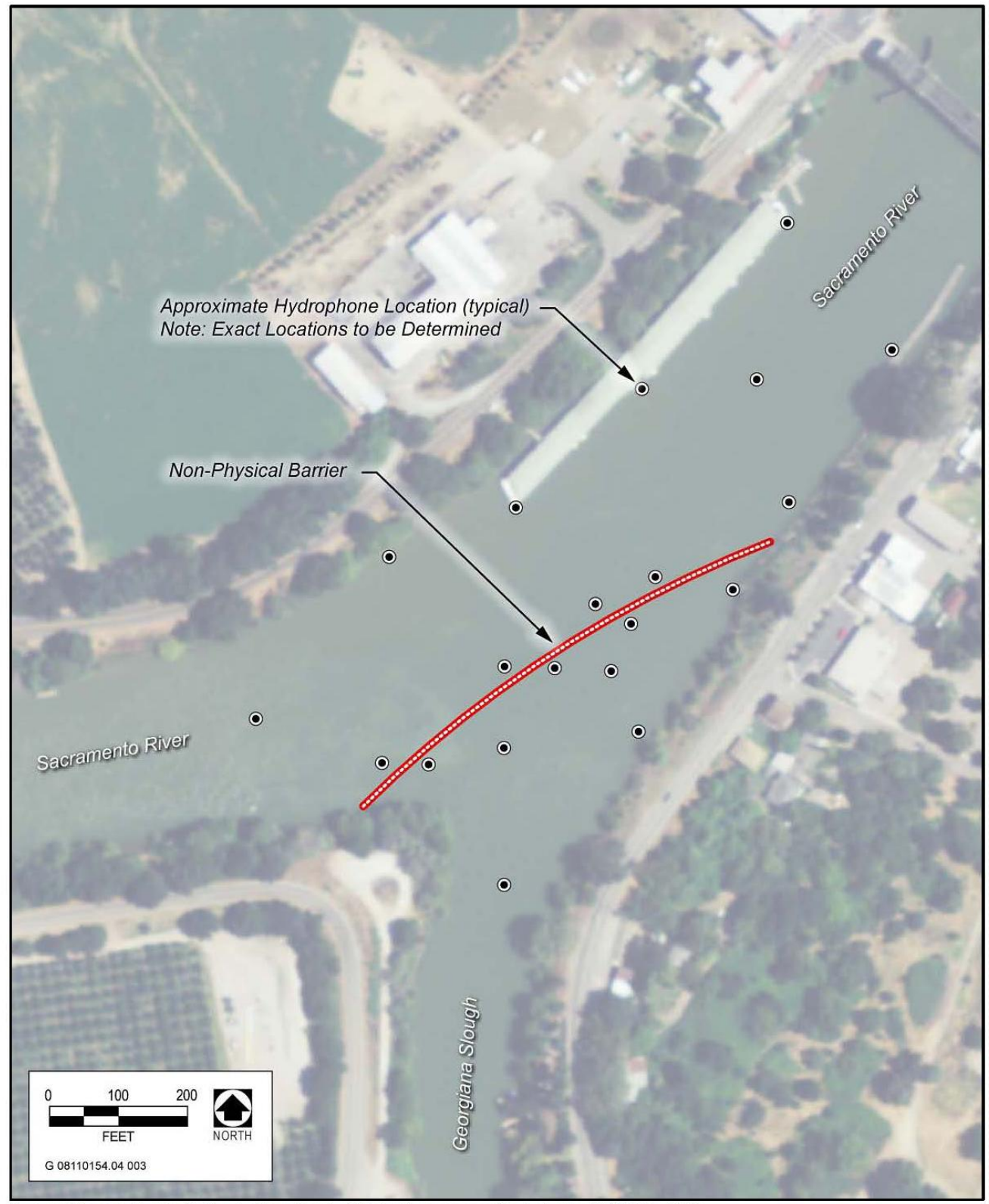
- Construct Bio-acoustic Fish Fence across Georgiana Slough
- Acoustically tag 1,500 juvenile salmon
  - Released in groups of 4-5 fish every 3 hrs throughout the duration of the study
- Acoustically track through study area
- Determine fate of fish
- Determine barrier efficiency



Source: Data provided by California Department of Water Resources and adapted by AECOM in 2011

Study Plan Overview

- Barrier Layout
- Hydrophone Positions Utilized for 3D Fish Tracking



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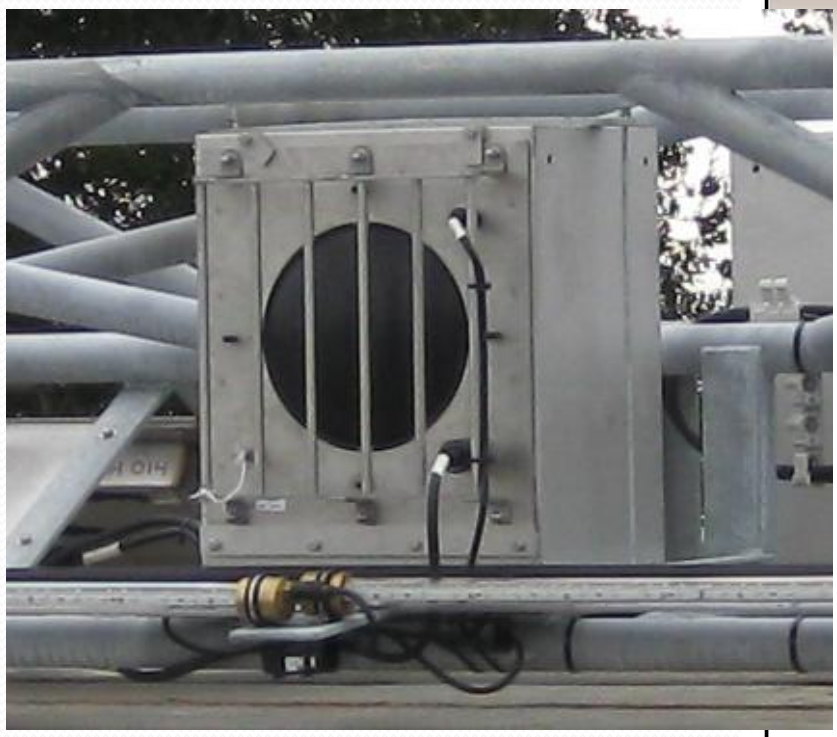
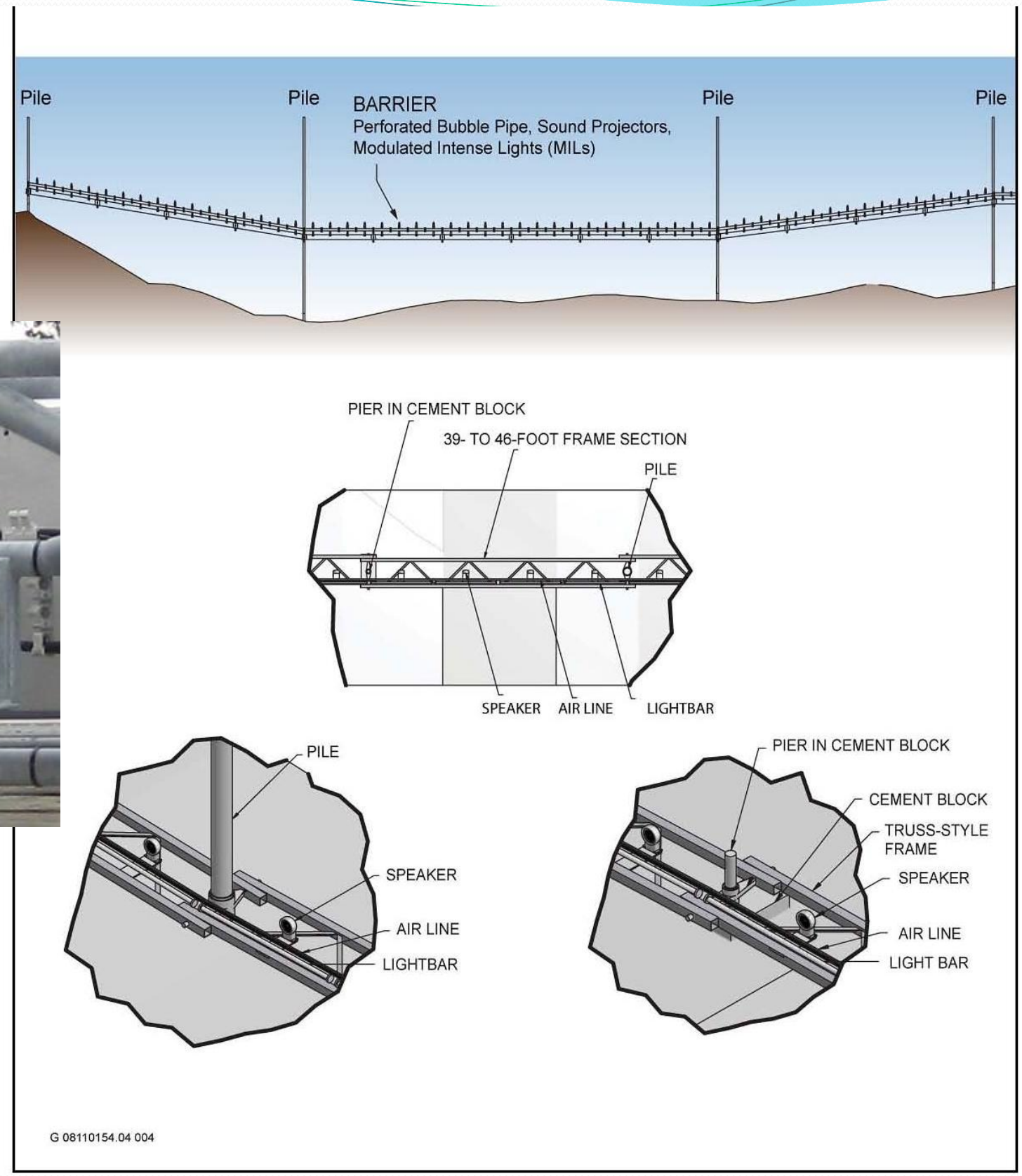
Barrier Design





Barrier Operation

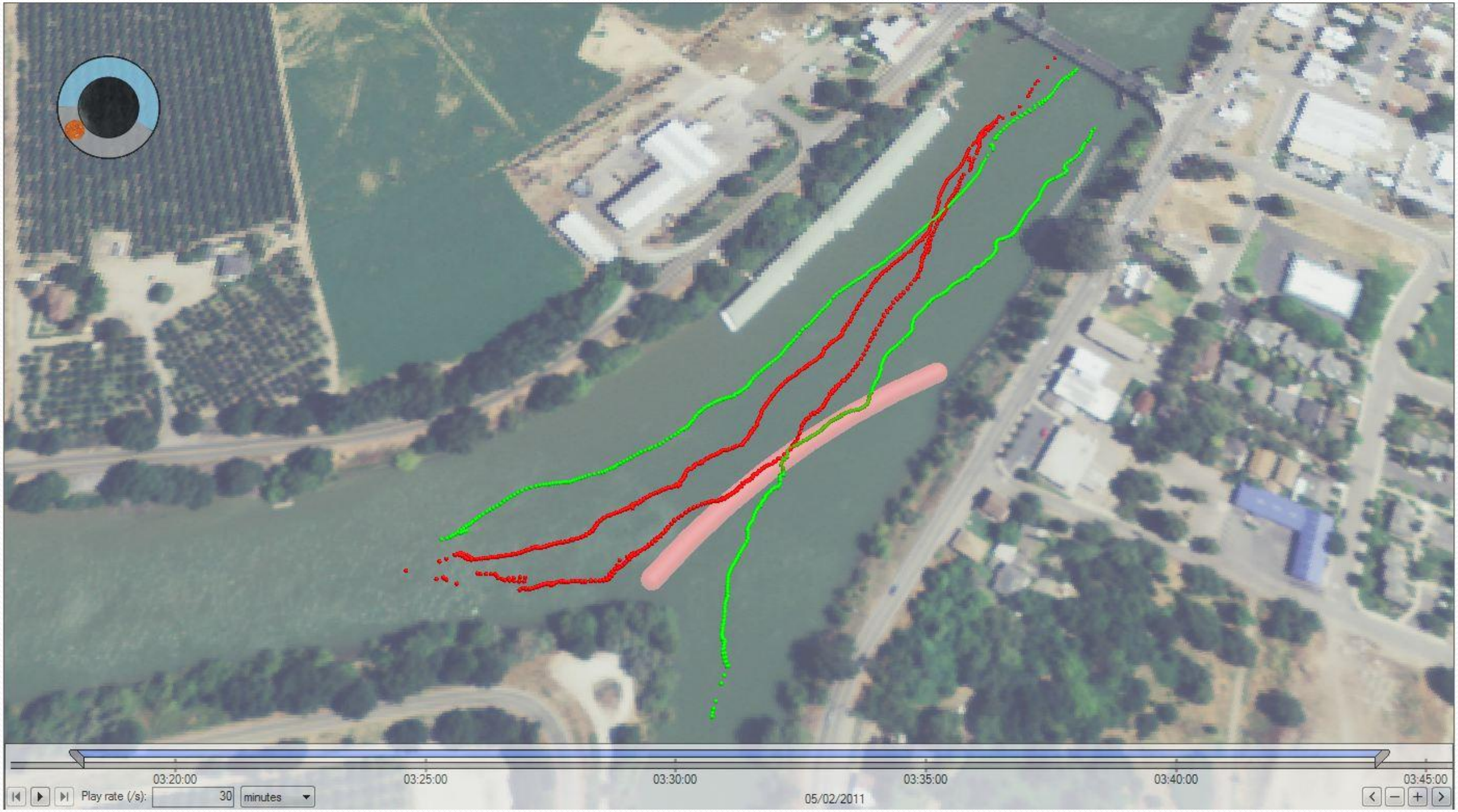
- Operated for periods of approximately 25 hours “on” and “off” in order to compare deterrence efficiency for the two different barrier states
- On-Off time periods were defined to approximately account for one full tidal cycle.
  - Tidal cycles shift by approximately 50 minutes each day
  - Operations encompassed a full range of environmental conditions (day/night, tides, water quality)

PLAY NIGHTTIME BARRIER OPERATIONS VIDEO

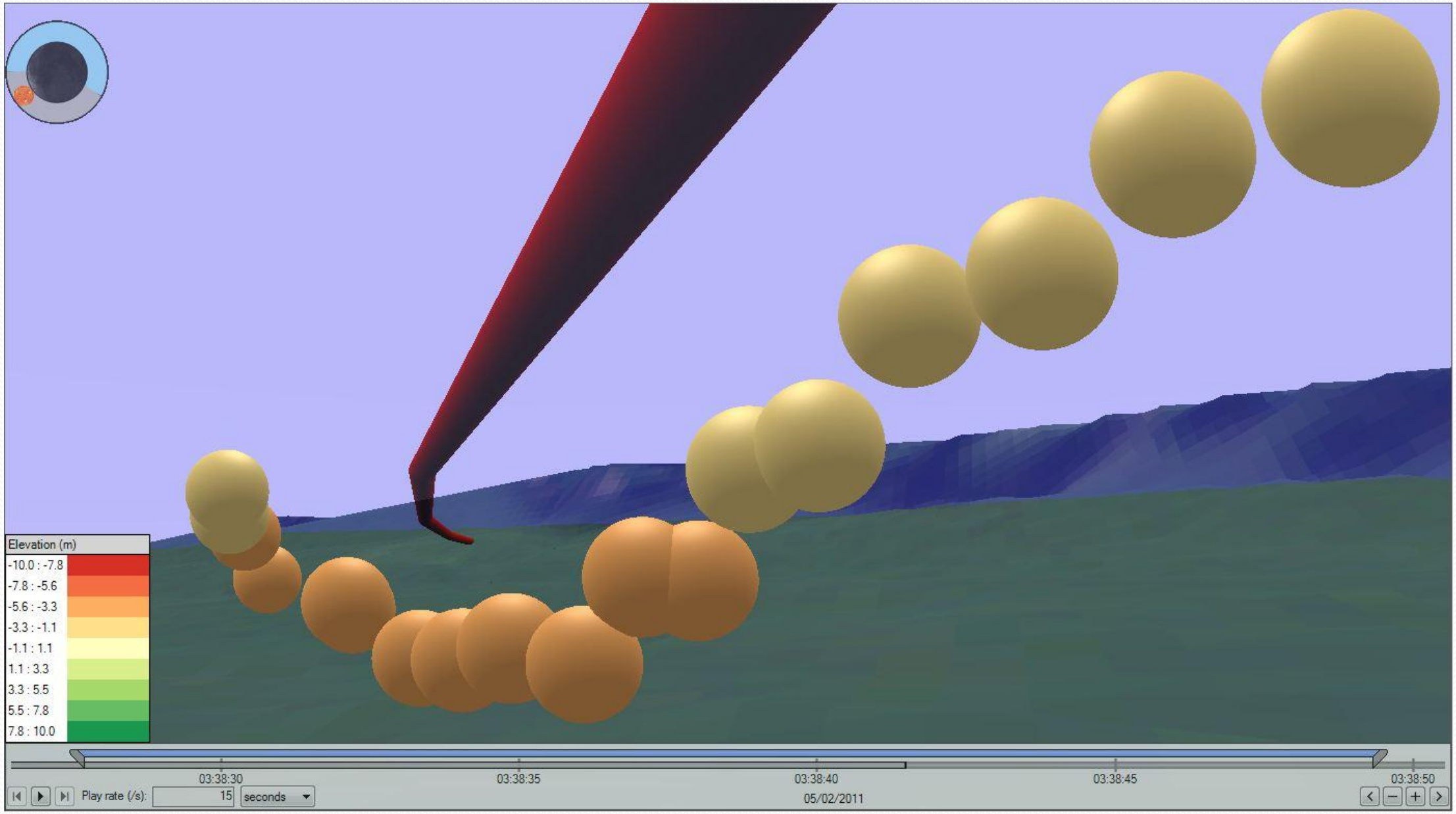
Barrier Operation-Night

Click to view animation of nighttime barrier operations.

Preliminary Results



Preliminary Results



Preliminary Results- Dependent Variables

- Deterrence efficiency
- Protection Efficiency
- Overall Efficiency

Preliminary Results

Click to view animation of approximately 4 days of barrier operations and fish tracks.

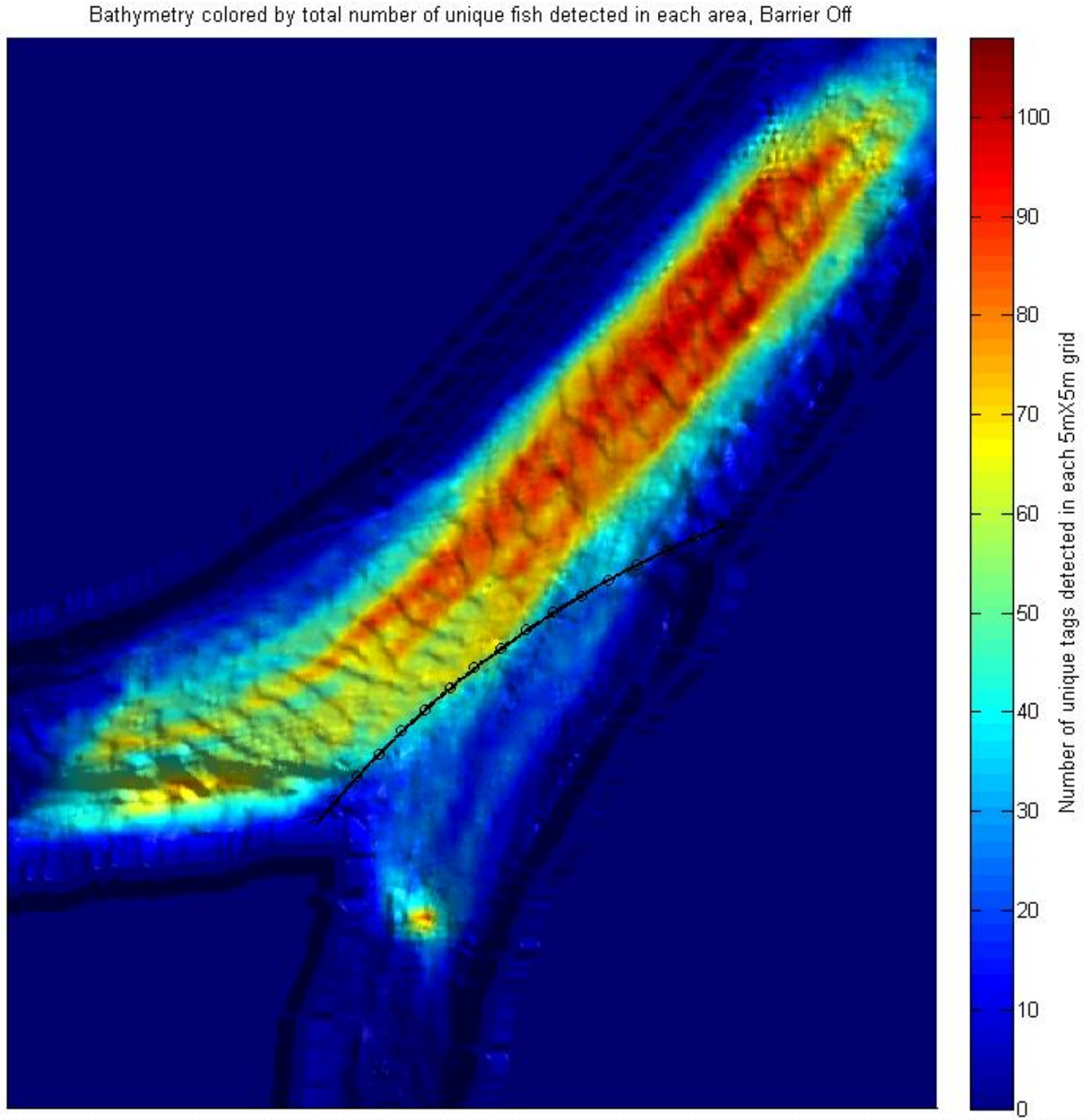
Preliminary Results- Chinook Approaching 0-80 meters from Barrier

	Number	Number	"Deterrence"
BAFF	Arriving	"Deterred"	Efficiency(%)
Off	508	233	31.4
On	396	329	45.4
	Number	Number Cont.	Protection
BAFF	Arriving	In Sacramento R.	Efficiency(%)
Off	714	555	77.7
On	701	647	92.3

Preliminary Results- Chinook Approaching Within 5 meters of the Barrier

	Number	Number	"Deterrence"
BAFF	Approaching < 5m	"Deterred"	Efficiency(%)
Off	181	78	30.1
On	232	155	66.8

Preliminary Results-Spatial Analysis of Fish Densities Barrier Off



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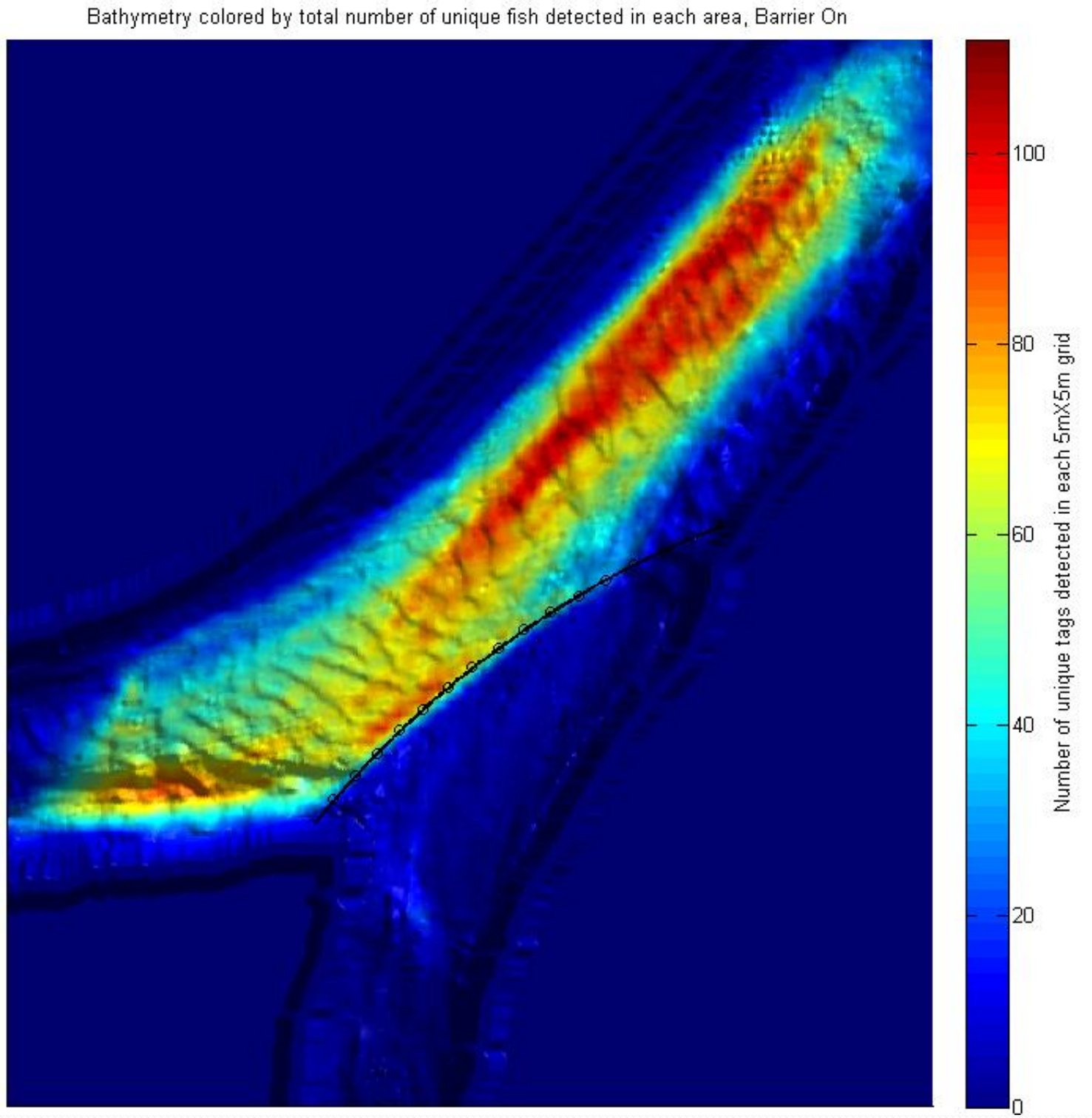
Preliminary Results-Spatial Analysis of Fish Densities Barrier On



2011 Study Conclusions

- 78% of Fish Stayed in the Sacramento River with the Barrier Off
- With the Barrier On the Percentage of Fish that Stayed in the Sacramento River Improved to 92%
- Deterrence Efficiency Greater for <5 meters than 5-80 meters
- Deterrence Efficiency:
  - <5 meters—36.7%
  - All distances—14%
- Spatial Analysis shows large reduction of fish entering Georgiana S. due to Barrier
- Tracks of Predator y Fish are Qualitatively Different than Chinook Salmon Tracks

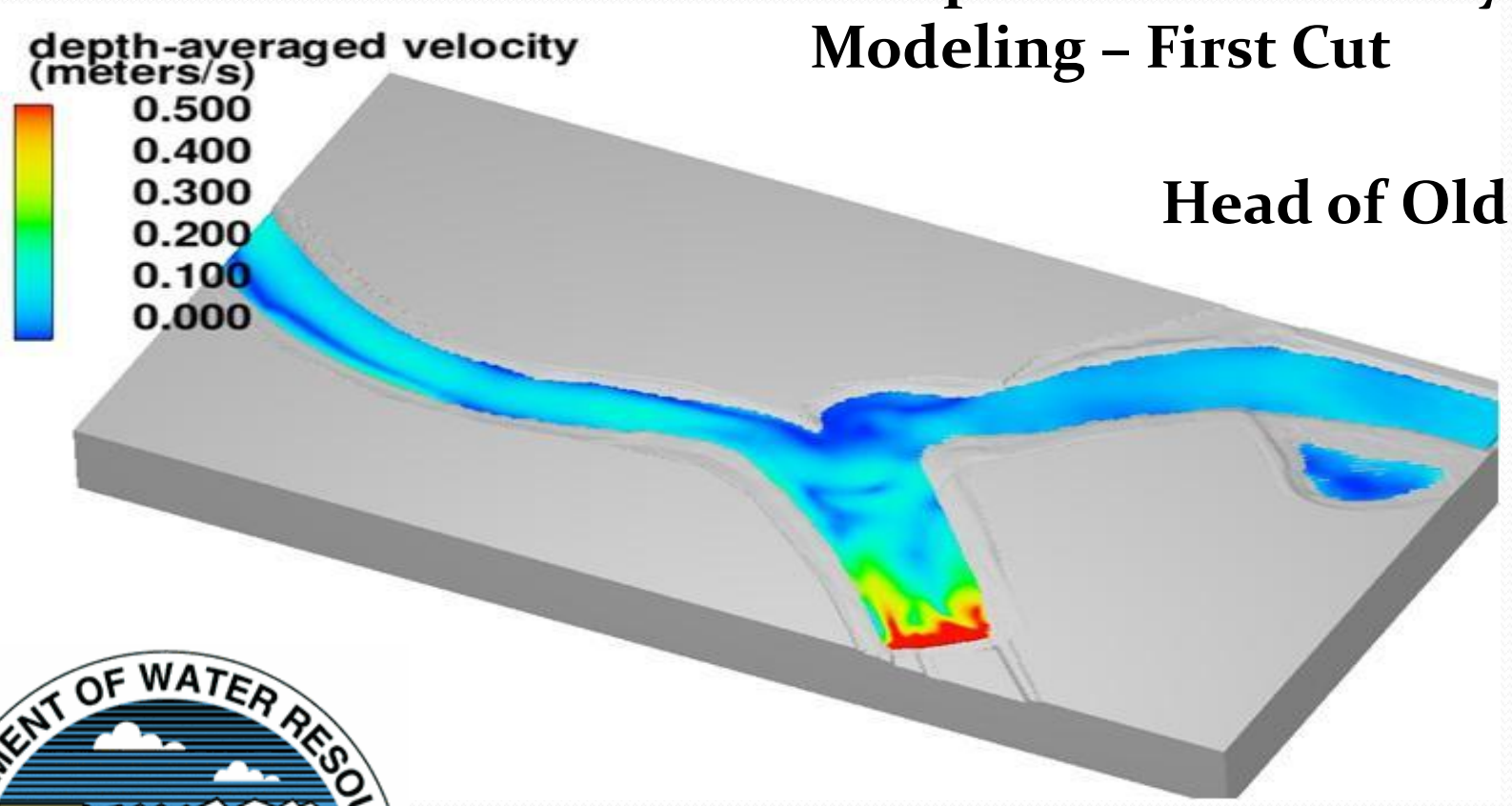
Possible Future Considerations for Non-Physical Barrier Evaluations

- Investigate Barrier/Predator Interactions
- Population Scale Effects of Barrier in Future Studies
- Long Term Operations Feasibility
- Alternate Barrier Alignments to Increase Efficiency at Upstream and Down Stream Ends
- Barrier Configurations at Alternate Junctions

Individual Based Modeling

Computational Fluid Dynamics Modeling – First Cut

Head of Old River



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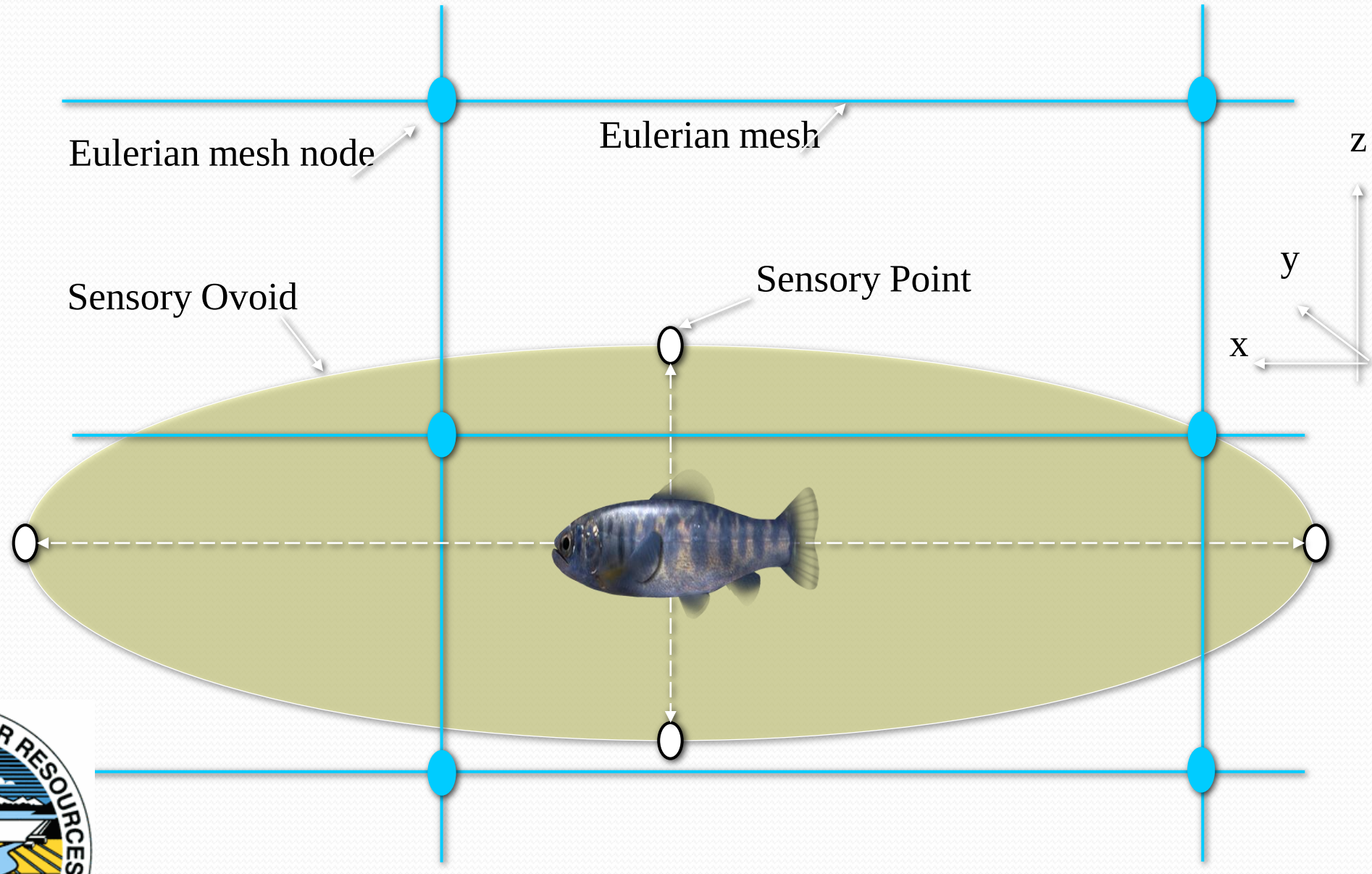
Sensory Ovoid and attributes of ELAM



List of Constraints

- **Default-swim downstream**
- **Bed shear-swim to increased velocity**
- **Avoid High Gradient-swim toward lower velocity gradient**
- **Pressure-swim away from pressure**
- **Sound-swim away from encapsulated sound (away from bubble curtain)**
- **Light-swim away from light (MIL)**

Validation

- **Split 2D tracks from the 15 releases in half**
- **Give ½ to ELAM modelers**
- **ELAM modelers calibrate and tune model**
- **Then ELAM modelers predict 2nd ½ of 2D tracks and the deterrence efficiency**
- **Pass back to statistician**
  - **Compare predicted to observed deterrence efficiency**
  - **No statistical difference = validated model**

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Questions


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REBELLIOUS SALMON